Medicinal Plant Review: *Gambhari* (*Gmelina arborea*)

[1]Dr. Abhijeet D. Kumbhar, [2]Dr. Shamal S. Naikare, [3]Dr. Guruprasad Nille.
[1]Assistant Professor, [2]Medical Officer, [3]Assistant Professor
[1]Department of DravyaGuna, SAS Ayurvedic Medical College, Harhua, Varanasi.
[2]Zilla Parishad Ayurvedic Dispensary, Nerle, Tal. Vaibhavwadi, Dist. Sindhudurg, Maharashtra.
[3]Department of Rasashatra, SAS Ayurvedic Medical College, Harhua, Varanasi.

Abstract:

Ayurveda is the science of life practiced by ancient Sages which is based on *Atharvaveda*, one of the oldest scriptures of Hindus. The objective of Ayurveda is to counteract the imbalance of three very essential elements *Vata, Pitta, Kapha* which constitute the *tridoshas* from which the body originates. It is the *Tridoshas* which regularises the normal working of human body. The entire science of Ayurveda is based on *Triskandha* namely *Hetu, Linga, Oushadha*. Amongst these, *oushadha* is very important in knowing the therapeutic applications.

In this modern era, there is need to evaluate the efficacy of the crude herbal drugs, in justifying their acceptability in modern system of medicine. In regards with the evaluation and standardization of drugs, different technique like morphological, microscopical, physical, chemical and biological evaluation is involved

Morern lifestyle and diet has given rise to imbalance of *Doshas* which is leading to eruption of many diseases including Non Communicable Diseases in which most of diseases lacks complete cure.

Ayurveda is a complete & holistic system in which a number of drugs with multiple beneficial actions are available though a massive research is required to prove the beneficial effects of the drugs.

Gambhari (Gmelina arborea) is a well-known drug mentioned in Ayurveda used for various puroses by *Acharya Charaka*, *Acharya Sushruta, Acarya Vagbhata* and most of *Nighantus* in Ayurvedic literature also some *Nighantus* has specifically mentioned uses of parts of *Gambhari*.

Hence, plant *Gambhari* is been selected for complete Medicinal Plant Review a step towards standardization Ayurvedic Medicinal Plant.

Index Terms: *Gambhari, Gmelina arborea*, Ayurveda, Medicinal Plant

Introduction:

Gambhari (*Gmelina arborea*) commonly known as Chandahara tree, Goomer teak is a small to medium tree belonging to family *verbenaceae*. The tree grows in the hilly areas of the Himalayas, Nilgiri and also on the eastern and western coast of India.

The genus Gmelina was named by Carl Linnaeus in honor of Johann Georg Gmelin (1709-1755), who was professor of Medicine, Botany and Chemistry in Tubingen, Germany and an explorer in Siberia in the service of the Tsar of Russia.

Literature Review:

Literature review of *Gambhari* (*Gmelina arborea*) was done from *Vedas* up to recent works to obtain thorough knowledge about *Gambhari.*

Vedic period[1]:

In ancient Indian literature like Vedas, the synonyms of *Gambhari* like *Rohini, Kashmarya* and *Shriparni* etc have been described. For the first time the name *Rohini* was mentioned in *Atharvaveda* where it is considered as *Asthi sansthapaka* and *Keetanu nashaka*.

The name *Kashmarya* is given in *Shatapatha Brahman* where it is explained as disinfectant.

Brihatrayis:

In *Charaka Samhita*[2] it is mentioned in *Shothahara Varga, Dahaprashamana Gana, Virechanopaga gana, Phalavarga and Madhura skandha* and used in *Chyavanaprasha* as a *kwatha dravya* (*Chi*.1/43), as a content of *Madhukadi Kashaya* in fever

(*Chi*.3/206), as a *pathya shaak* in *Raktapitta* (*Chi*.4/39), as *Kashmaryadi Ghrita* in *Kasa* (*Chi*.18/163), in *Dashamuladi Ghrita* as a *vatanashaka* (*Chi*.28/121) and as a *Virechanakaraka Yoga* (*K*.7/30).

In *Susruta Samhita*[3] *Gambhari* is mentioned in *Sarivadi Varga, Dashamula, Phalavarga, Madhura Gana* and *Brihatapanchamula* and used in fever as a content of *Drakashadi kwatha* (*U*. 39/179), in *Murcha* along with *Kharjura* and *Chironji* (*U*. 46/16).

In *Ashtanga Hridaya*[4], it is mentioned in *Brihata panchamoola, Madhura Varga* and *Sarivadi Varga* and used for Fever as a content of *Sarva Jwara nashaka yoga (Chi*. 1/55), in Heart diseases as a content of *Shwadanshtradi Ghrita* (*Chi*. 3/26), for fever as *Kashmaryaadi Ghrita*, in *Indriya bhrinsha* (U. 24/51), as a content of *Mahamayura ghrita* and as a content of *Kashmaryadi Ghrita* in *Guhyaroga* (*U*. 34/39).

Nighantu

Bhavaprakasha Nighantu[5] has mentioned *Gambhari* in *Guduchtadi varga* and Synonyms and *guna* are mentioned. *Bruhana, vrushya etc guna* are mentioned. *Utpatti sthana*, Physical characteristics, *Rasayanika sanghatana, Prayojanga, Matra*, Adulterated and substituted plant (*Premna flavescens Ham. Trewia nudiflora Linn.*) With their physical characteristic are mentioned.

Priya Nighantu[6] has mentioned *Gambhari* in *Haritakyadi varga* and Synonyms like *Kashmarya, Kashmari* and *Gambhari* are mentioned. The physical characteristics of leaves, fruits and bark along with its guna are mentioned.

Dhanvantari Nighantu[7] has mentioned *Gambhari* in *Guduchyadi Prathama varga* and synonyms of *Gambhari* like *Heera, Madhuparni* and *Shriparni* etc are mentioned along with *guna* of *Gambhari* like *rasa (tikta), guna (guru), veerya (ushna)*. Causes *shamana* of *Raktpitta, Tridosha, Shrama, Jwara, Visha* etc. The *utpattisthana* of *Gambhari* (Himalaya), *mukhya aamayik prayoga (vrushya, balya etc), prayojya anga, vishishta yoga (panchamuladi kwatha)* is also mentioned.

Raj Nighantu[8] has mentioned *Gambhari* in *Prabhadradi varga* and Synonyms in different language (Tamil- *Salaguma vuti chettu* etc) are mentioned.

Prayojya anga- Twaka, Patra, Pushpa, Phala, Phala majja and *Matra - Phala swarasa* 10-20gms. Are mentioned.

Kaiyadeva Nighantu[9] has mentioned *Gambhari* in *Aushadhi varga* and Synonyms are mentioned. *Guna dharma* of *Gambhari shosha, shamana, aama dosha nashaka, arsha nashaka, shoola nashaka, jwara nivaraka*. Also *guna* of *Gambhari phoola* and *phala* are also mentioned.

Shaligram Nighantu[10] has mentioned *Gambhari* in *Guduchyadi varga* and Synonyms like *Subhadra, Grushti, Sthula twacha, Madhumati, Modini, Mahakumudini* etc. are mentioned. Different *guna* of Gambhari phala, pushpa, mula are mentioned.

Synonyms:

- *Kashmari- It is famous because of its good qualities.*
- *Kambhari (Gambhari)* - It possesses plenty of water
- *Peetarohini* - It possesses yellow flower
- *Madhuparni* - Its leaves are as sweet as honey
- *Shreeparni* - Its leaves are very beautiful
- *Sarvatobhadra* - Each part of this tree has medicinal value.
- *Kashmiri* – It is found in Kashmir.
- *Krishnavrinta* – It has blakish petiole.
- *Bhadraparni* – It has beautiful leaves.
- *Mahakusuma* – It has long inflorescence.
- *Vaatahrut* – It is a good remedy for vatika disorders.
- *Suphala* – Fruits are wholesome.
- *Sthoolatvaka* – It ha thick stem bark.
- *Heera* – Fruits are used as Rasayana.

Vernacular names[11]:

Language	**Names**
Latin	*Gmelina arborea*

English	Chandahara Tree, Coomb teak, Beech wood, Gmelina, Goomar teak, Kashmir teak, Malay beechwood, White teak
Bengali	*Gamari, Gumbar*
Gujrati	*Sheevan*
Hindi	*Shevana, Gambhar, Gumhar, Kamhari, Sewan*
Marathi	*Kashmari, Shiwan*
Orrisi	*Gambari, Bhodroparanni*
Punjabi	*Kumhar, Ban*
Tamil	*Arisa, Kumadi*
Telagu	*Peddagumadu, Gumartek, Gummadi*
Urdu	*Gambhari*
Kannada	*Shivani.*
Mallyanam	*Kumbili, Kumil.*

Pharmacodunamics:

- *Rasa : Tikta, kashaya, madhura*
- *Veerya : Ushna*
- *Vipaka : Katu*
- *Guna : Guru*

Scientific Classification[12]:

Kingdom	Plantae
Division	Tracheophyta
Subdivision	Spermatophytina
Class	Magnoliopsida
Order	Lamiales
Family	*Verbenaceae (Lamiaceae)*
Genus	Gmelina
Species	arorea

Distribution[13,14]:-

An unarmed tree 60ft. high, with a clear bole of 20-30ft and a girth of 5-7ft found scattered in deciduous forests throughout the greater part of India and Andamans, upto an altitude of 5000 ft.

The tree grows in the hilly areas of the Himalayas, Nilgiri and also on the eastern and western coast of India.

In India it occurs extensively from the Ravi, eastwards in the sub-Himalayas tracts, common throughout Assam and adjoining areas of northern West Bengal, also in southern India and planted elsewhere on a large scale, Gamhar most commonly occurs in West Bengal forests in mixed forests

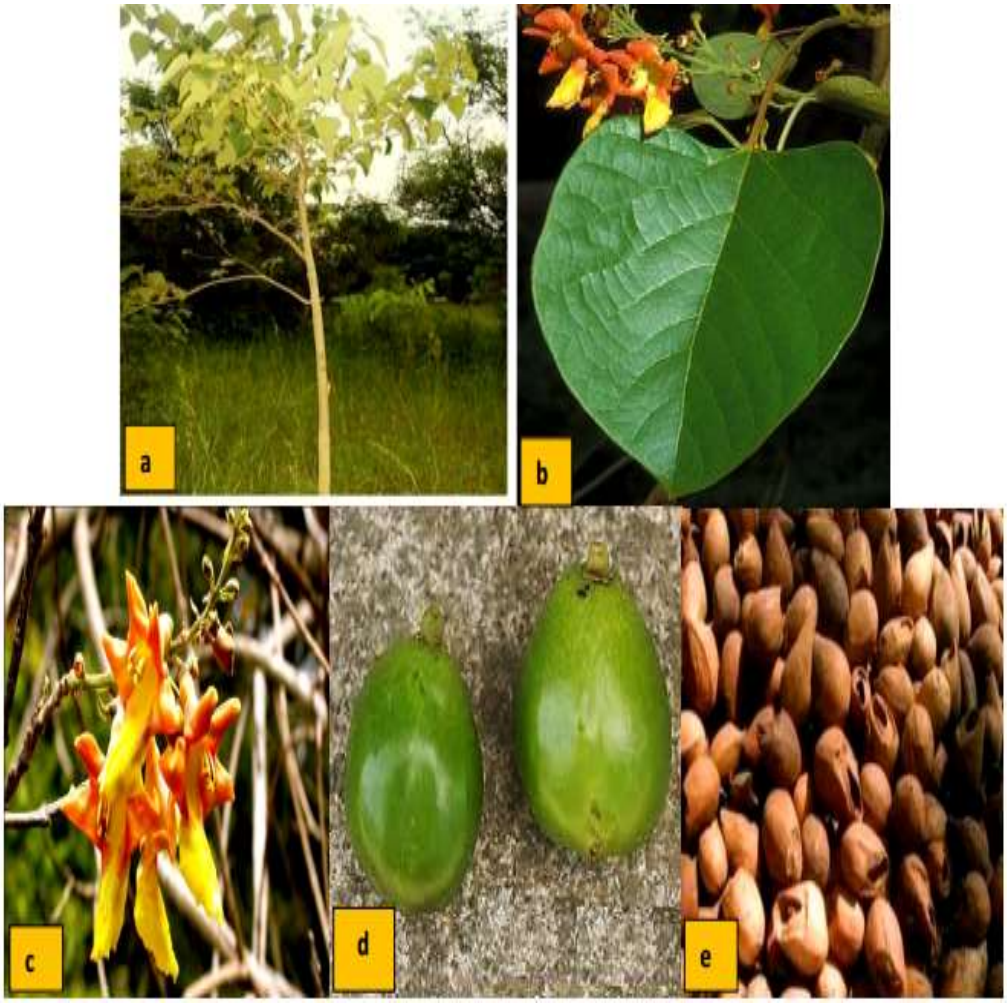
Botanical Description[15,16,17,18]:

Macroscopic characters:
Root: Nearly cylindrical with uneven surface, greyish brown, brittle.
Stem: Exfoliating in thin flakes, Whitish, Grey.
Leaf: Opposite, broadly ovate, cordate, glandular, glabrous above when mature, fulvous-tomentose beneath. Sometimes pinnately or palmly compound 10-15 cm long, 5-18cm wide.
Colour: Dark green.
Taste: Sweet.
Odour: Sweetish.
Flower: Beautiful brownish-yellow in terminal panicles.
Fruit: Fleshy ovoid drupes, orange-yellow when ripe. A drupe, ovoid, crinkled, black, 1.5-2.0 cms long, sometimes with portion of attached pedicel, 1-2 seeded, sometimes 1 seeded; taste sweetish, sour.

Microscopic characters:
Roots: Transverse section of leaves shows 6-8 layers of cork cell arranged in tangential direction and broken at places towards upper layers. Cortex is composed of thin walled parenchymatous cells with starch grains; resin ducts present in abundance throughout cortex; scatterd stone cells and fibres present, occuring mostly in singles; some cortical cells contain rosette crystals of calcium oxalate and oil globules. Primary phloem is characterised by the presence of sieve tubes with companion cells, phloem parenchyma, soft bast fibres and ray cells.
Fruit: Microscopically fruit shows pericarp differentiated into single layered pericarp, multi-layered mesocarp and endocarp. Epicarp consists of single layer of thin walled cells; mesocarp composed of several layers of iso-diametric, thin walled, parenchymatous cells; endocarp consisting of multi-layered schlerenchyma. Fruit powder is blackish brown and shows stone cells, oil globules and aleurone grains.
Leaf: Microscopically leaves shows fragments of transversely cut cork cells and in surface view, isolated or groups of stone cells and sclereids of various sizes, shapes and thickness, longitudinally, radially and tangentially cut medullary rays embedded with acicular crystals of calcium oxalate. Simple and compound starch grains, scattered as the parenchymatous cells and also consists of crystal fibers and idioblast with stone cells.
Flowers: Complete bisexual, bracteate, borne in cymose, panicles (compound inflorescence having combined sepals) with brownish-yellow colour, shortly pedicelled.
Calyx: 0.5 cm long Gamosepalous (having combined petals), Campanulate with 5 teeth, pale greenish yellow and tomentose.
Corolla: Gamopetalous bilabiate (having two lips) 5 lobed (3+2) lobes recurred 2-3cms. Long, dense hairy outside, yellowish brown with yellow and brown spots.
Gynaecium: Superior 4 celled with one ovule in each cell, style slender and stigma shortly bifid.

Figure No.1

Gambhari



a : Whole Plant b : Leaf c : Flower d : Fruits e : Seeds

Chemical composition[15]:-

Root: Gmelofuran-a, furanosesquiterpenoid, sesquiterpene, cerylalcohol, hentriacontanol-1, beta-sitosterol, n-octacosanol, gmelinol, apiosylskimmin-a,
apiofuransonyl-(1→6)-beta-D-glucopyranosyl, (1.0.7)-umbelliferone

Leaf: cluytyl ferulate, n-octacosanol, gmelinol, arboreal, 2-0-methyl arboreal, 2-0-ethylarboreal, isoarboreal, gmelanone, beta-sitosterol, paulowin, 6"-bromoisoarboreal, 4-hydroxysesamine. 4,8-dihydroxysesamin, 1,4-dihydroxysesamin (gummadiol), 2-piperonyl-3-(hydroxymethyl)-4 (alpha-hydroxy - 3-4-methylenedioxybenzyl)-4-hydroxy tetrahydrofuran (I), 4-epigummadiol-4-0-glucoside, 1,4-dihydroxy-2,6-dipiperonyl-3,7-dioxabicyclo [3,3,0]-octane, gmelanone, palmitic, oleic and linoleic acids, stigmasterol, stigmastanol, campesterol, alpha-2-sitosterol, butulinol (heartwood); luteolin, apigenin, quercitin, hentriacontanol, beta-sitosterol, quercetin, hentriacontanol, beta - sitosterol, quercetogenin and other flavons.

Medicinal Uses[16]:

Classical - *Bahya prayoga*:

- Burning and pain : Because of cooling and soothing actions, the leaves relieve burning and pain. In such cases leaves are tied to the affected part.
- Fever induced headache : Paste of leaves is applied over fore head in case of head ache caused by fever.

- Gout : Pulverised root is applied locally for gout.

***Abhyantara prayoga*:**

- Central nervous system : It is used in vertigo, brain debility and vata disorders. It is also a brain tonic.
- Digestive system : Fruit relieves excess thirst; root aperient, improves appetite and digestion, so used in diarrhoea, Constipation and haemorrhoids.
- Circulatory system : The bark of the root is used internally in oedema due to any cause, as it relieves oedema. Its ripe fruit is Cardio tonic. Its juice is useful in cardiac disorders. The mixture of roots of *Gambhari* + gunja leaves + yashtimadhu + sugar with milk is a good galactagogue.
- Respiratory system : Ripe fruit is a nutritive tonic, so useful in tuberculosis and cachexia.
- Urinary system : Fruits and leaves are diuretic. The juice is given in dysuria, gonorrhoea and cystitis. In such cases if the juice is given along with cow's milk and sugar, it increases urination, relieves pain and swelling.
- Reproductive system : Besides being a galactagogue, the fruit is aphrodisiac. Fruits are used in semen debility and to prevent miscarriage. Decoction of the root bark is given in postpartum disorders. It relieves uteritis, fever and other symptoms and promotes breast milk. Tampon oil derived from *Gambhari* juice is kept for breast development.
- Temperature : Relieves fever and burning.
- Satmikarana : The bark is bitter tonic having nutritive and rejuvenating properties. It is also an antidote. The bark is used in post pyrexial debility. It is also used externally and internally in scorpion and snake bite.

Home remedies[17]:

- Juice of young leaves - Indication: cough medicine.
- Paste of leaves - Indication: Headaches associated with fever.
- Juice of young leaves - Indication: Ulcer washes eg. In ulcerative colitis or intestinal infections.
- Shade dry *Gambhari* fruits powdered form - Indication: Leucorrhea
- Young leaves of *Gambhari* boiled and prepared like tea - Indication: Tridosha control.
- *Gambhari* fruit with mishri in same amount - Indication: urticarial
- *Gambhari* bark with neem bark 5 gm each boil in 200gm of water. Left 50gm.
- All skin problems, Constipation, Blood related problems.

Other uses[18]:

- The good quality of *Gambhari* wood pulp is used in manufacturing cardboard and various grades of papers. Also furniture and musical instruments.
- *Gambhari* leaves are used for silk worm culture.
- *Gambhari* is harvested on large scale for fuel wood.
- The nectar obtained from its flowers yield high-quality honey.

Doses[16]:

Root Powder : 1-3 Grams
Decoction : 20-30 Ml.

Substitution And Adulteration[16]:

- Substitution :
  - Roots - Roots of *Gmelina asciatica*
  - Leaves - leaves of *Premna flavescena Ham.*
  - Fruits - fruits of *Vitis vinifera*
- Adulterants: Mostly *Trewia nudiflora Linn*. Is used as adulterant as it has similar names in local language as *Shivani or Gamhar*.

Pharmacological studies[19]:

- **Toxicity Study:** Acute and sub acute toxicity study of powder of fruits of Gmelina arborea Roxb (test drug) was conducted in two schedules (Acute and sub acute toxicity studies) with different doses of 300mg, 500mg and 1g/kg for 28 days. None of the doses of this test drug produced mortality or behavioral changes. Thus the test drug at a dose of 2g/kg was proved to be non toxic without causing any kind of variations among behavior, hematology, bio-chemistry and histology of vital organs.
- **Antioxidant Activity[20]:** Effect of antioxidant activity of methanolic extracts of stem bark of Gmelina arborea Roxb. (MEGA) was studied using various in vitro assays method which showed free radical concentration to that of

standard ascorbic acid which was 89.58% due to proton donating ability and could serve as free radical inhibitors or scavengers.

- **Anthelmintc Activity[20]:** Alcoholic and aqueous leaves extracts of Gmelina arborea Roxb. exhibited anthelmintic activity in dose dependent manner giving shortest time of paralysis and death compared to piperazine citrate, especially with 100mg/ml concentration for Pheretima posthuma and Ascardia galii worms by increasing chloride ion conduction of worm muscle membrane that produced hyper polarization and reduced excitability that lead to muscle relaxation and flaccid paralysis.
- **Anti Microbial Activity[20]:** The crude leaf and stem bark extracts of Gmelina arborea Roxb. showed significant anti-microbial activities against gram positive and gram negative organism and the activity could be due to the presence of bioactive compounds such as alkaloids, saponins, carbohydrates, phenolics, tannins and anthraquinone but no cardiac glycosides in leaf while in stem bark possessed alkaloids, saponins, carbohydrates, tannins and anthraquinone but no phenolics. In Vitro study of both stem bark and leaf extracts shown significant activity against E. coli,K. pnemoniae, P. dysentria and S. typhi.
- **Diuretic Activity[20]:** Gmelina arborea Roxb. methanolic extract have shown significant diuretic activity on albino rats. Extracts were given at the dose of 250mg/kg and 500mg/kg body weight. Sodium (Na+), Potassium (K+) and chloride (Cl+) output in urine markedly increased as compared to normal saline. The Gmelina arborea Roxb. Extract exerted its diuretic activity due to synergistic action of (HCO3-/Cl-), (HCO3+/H+) exchangers and the (N+/H+) antiporter by inhibiting tubular re-absorption of water and accompanying anions to cause dieresis. There was an increase in the ratio of concentration of excreted sodium and potassium ions after methanolic extract of Gmelina arborea Roxb. treatment.
- **Cardioprotective[20]:** Ethanolic extract of Gmelina arborea Roxb. has shown potential protective effect against doxorubicin (DOX) induced cardiactoxicity by increasing cardiac markers activities in plasma. The significant increased the activities of cardiac markers such as SGOT (Serum glutamic oxaloacetic transaminase), SGPT (Serum glutamic pyruvic transaminase) and ALP (Alkaline phosphate test) in plasma of DOX (20mg/kg) treated rats might be due to enhanced susceptibility of myocardial cell membrane to the isoproterenol mediated peroxidation damage resulting in increased release of these diagnostic marker enzyme in to the systemic circulation.
- **Anti Diabetic Activity[20]:** Ethanolic extract of Gmelina arborea Roxb. bark at dose of 420mg/kg and chlorpropamide at dose of 200mg/kg ($p<0.05$) was found to reduce the increase of blood sugar in streptozotacin (50mg/kg) induced diabetes due to the increased blood GSH (Glutathione) levels reinforcing the role of GSH as free radical scavenger and in the repair of free radical caused biological damage.
- **Immuno Modulatory Activity[20]:** Methanolic extract of Gmelina arborea Roxb. and ethyl acetate fraction of methanolic extract have been found to increase the total WBC count, which was lowered by cyclophosphamide, a cytotoxic drug. The drug is also capable of normalizing the levels of neutrophils and lymphocytes. The results indicates that the Gmelina arborea Roxb. can stimulate the bone marrow activity. As the drug is capable of reducing the cyclophosphamide induced toxicity, it can be useful in cancer therapy also.
- **Antipyretic and Analgesic Activity[20]:** Gmelina arborea Roxb. bark extract was evaluated and the ethanolic and aqueous extract found to reduce the hyperthermia at the rate of 420mg/kg body weight 1hrs after the administration and its effect is comparable to that of the standard antipyretic drug paracetamol at the dose of 50mg/kg body weight. Whereas chloroform and benzene extract reduced the temperature 3h after their administration but have mild effects. However the analgesic activity of ethanolic and queous extract (test compounds) was found to be more significant on acetic acid induced test than tail flick test as compared to standard diclofenac sodium at a dose of 25mg/kg and thus it appear that the test compounds inhibit predominantly the peripheral pain mechanism.

Conclusion:

On comprehensive review of *Gambhari* it is found that *Gambhari* is described in Vedas, Brihatrayies & Laghutraies. Various synonyma like *Kashmari, Kambhari (Gambhari), Peetarohini, Madhuparni, Shreeparni, Sarvatobhadra.,Kashmiri, Krishnavrinta, Bhadraparni, Mahakusuma, Vaatahrut, Suphala, Sthoolatvaka and Heera* are described in various *Nigantus*. *Gambhari* (*Gmelina arborea*) belongs to family *Verbenaceae* and commonly known as Chandahara Tree, Coomb teak, Beech wood plant. Its ftuit is used in Daha, Hudroga, Kshaya and Rakta Pitta whereas root is used in shopha, Jwara, Daha, Raktadosa, Vatavikara, Arsha, Raktapitta and Bhrama.

Gambhari is having *Guru Guna, Tikta, kashaya, madhura rasa, Ushan Veerya and Katu Vipaka*. On account of above properties it is *Jearhara, Shophahara, Dahahara, Raktadoshahara, Bhramahara and Arshahara.*

References:

1. Kapila Deva Dwivedi 2001 Ed, Vedome ayurveda, Vedome nirdhishta vanaspati, Varanasi: vishwabharti anusandhan parishad, page no.247
2. Agnivesa revised by Charaka & Dridhabala, 2006, Charaka *Samhita*. Ed. Vidyadhar Shukla, Prof. Ravidatta Tripathi, Vol I,II. Revised ed. Delhi:Chaukhambha Sanskrit Pratisthan;
3. Acharya Susruta, 2001. Sushruta Samhita. Ed. Dr. Anant Ram Sharma, Vol I,II,III. 1st ed. Varanasi:Chaukhambha Sanskrit Pratisthan;
4. Acharya Vaghbhata, 2000 Ashtanga Hridayam. Ed. Vd. Vaidya Yadunandan Upadhyay, 13th ed. Varanasi:Chaukhambha Sanskrit Sansthan;.
5. Bhavamishra, Bhavaprakasha Nighantu. 1998. Ed. Krishnachandra Chunekar Reprint. Varanasi:Chaukhambha Bharati prakashan; P.689.
6. Aacharya Priyavata Sharma, 1983. Priya Nighantu. 1st ed. Varanasi:Chaukhambha Surbharati prakashan; P.44.
7. Dhanvantari, Dhanvantari Nighantu. 1982. Ed. Dr. Jharakhanda Oza & Dr. umakripa Mishra 2nd ed. Varanasi:Chaukhambha Surbharati prakashan; P.170-171
8. Acharya Narahari Pandit, 2003. Raj Nighantu. Ed. Indradeva Tripathi, 3rd ed. Varansi:Chaukhambha Krishnadas Academy; P.193.
9. Kaiyadeva, Kaiyadeva Nighantu. 1979. Ed. Acharya Priyavat Sharma & Guruprasad Sharma, 1st ed. Varanasi:Chaukhambha Vishwabharati; P.138
10. Lala Shaligramagi Vaishya, 2000 ed. Shaligrama Nighantu. 1st ed. Mumbai:Khemraj Shrikrishnadas Prakashan; 1981. P.245-246.
11. Anonymous, Ayurvedic Pharmacopoeia of India, Vol 1 and 3, Govt. of India Ministry of Health and Family Welfare Dept. of ISM&H, New Delhi,
12. *Gmelina arborea*, Available from: URL: http://en.wikipedia.org/wiki/gmelina_arborea
13. Vd. V. M. Gogte, Oct. 2000 ed. Ayurvedic Pharmacology and Therapeutic use of Medicinal Plants, Part.2, Ch.14 Therapeutic Considerations, Mumbai: Bhartiya Vidya Bhavana, P.no 364,365,366.
14. B.N.Sastri, the Wealth of India, Vol. 4th, New Delhi: Council of Scientific and Industrial Research, 2002 Ed, P.no. 154-156
15. P.C.Sharma, M.B.Yelne, T.J.Dennis, 2005 Database of Medicinal Plants Used in Ayurveda, Vol-3, New Delhi: Central Council for Research in Ayurveda and Siddha, P.no.217-222.
16. Anonymous, Ayurvedic Pharmacopoeia of India, 2000 ed. Vol 1 and 3, Govt. of India Ministry of Health and Family Welfare Dept. of ISM&H, New Delhi,
17. Rastogi Ram P, B.N. Malhotra, 1sted. 1991, Compendium of Indian Medicinal Plants Vol. 1,2,3,4,5 published by Central Research Institute and Publication and Information. Directorate New Delhi:, vol.1-141, vol.2-237, 654, vol.3- 224,615, Vol.4-246,701, Vol.5-274,815.
18. Orient Longmann, Reprint 1996, 2001, 2002 ed. Indian Medicinal Plants, Vol. 3, Chennai: Orient Longmann Pvt. Ltd. 600 002, P.no. 91-95.
19. Ashalatha M, Kuber Sankh. 2014; 2(6): Toxicity Study of Gambhari Phala Churna. International Ayurvedic Medical Journal 959-963.
20. Kaswala Rohith, Patel Vaibhav, Chakraborty Manodeep, Kamath Jagadish V. 2012; 3(2): Phytochemical and Pharmacological profile of Gmelina arborea: An overview. International research journal of pharmacy 61-64.